

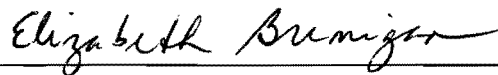
Math Anxiety: How It Affects Teachers and Students

An Honors Thesis (HONRS 499)

By

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A handwritten signature in cursive script, reading "Elizabeth Bremigan", is positioned above a horizontal line.

Ball State University
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April 2005

Expected Graduation Date
May 7th 2005

ABSTRACT

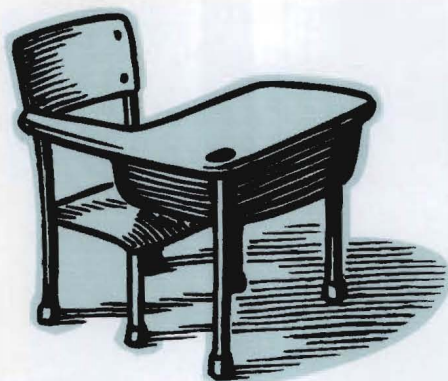
Middle school is a critical time in students' mathematical development and a time in which it is important for students to enjoy math and begin to understand mathematics at a conceptual level. Students who are unable to enjoy mathematics or perform in the classroom may be dealing with math anxiety. The project is intended to educate teachers on math anxiety and provide them with a measuring device, three questionnaires, to help identify math anxious students. Approximately 100 seventh and eighth grade students attending an urban middle school with relatively low socioeconomic status completed the questionnaires. Student responses to selected questions were analyzed and are presented and discussed. In addition, suggestions for how classroom teachers can address issues of math anxiety are presented.

ACKNOWLEDGEMENTS

- I would like to thank Dr. Bremigan for helping from the brainstorming stage through the completion of the project. Thank you for willingness to help whenever I called or emailed about the project. I really appreciated your suggestions, thoughts, guidance, and support throughout the project.
- I would like to thank the administrators and teachers for their willingness to let me give my questionnaires to their students. I would also like to thank the students for taking the time to answer the questions completely and honestly.
- I also owe thanks to Dr. Hartter for proof reading my thesis throughout the process. I also appreciated her support and encouragement during the project.

**MATH ANXIETY:
HOW IT AFFECTS TEACHERS AND STUDENTS**

By Mark A. Pinkerton



MATH ANXIETY

Scholars define math anxiety as an irrational fear of mathematics, a fear so strong that it causes students to freeze up in a math classroom. Students become too paralyzed to think, lose the ability to use the knowledge they have, and become extremely uncomfortable in class. Although many scholars define math anxiety as irrational, students who suffer from math anxiety state that the fear is not irrational, but a real fear formed from past math experiences. As a result, math anxiety is defined differently for each person and becomes difficult both to recognize and to overcome.

The symptoms of math anxiety vary depending on the student and the origin of the anxiety. Students who suffer from math anxiety may be anxious during tests, afraid to answer questions in class, afraid to ask for help, afraid to volunteer during class, avoid math in general, or simply struggle to pay attention during class. This list of symptoms is not exhaustive and changes based on each individual student. Math anxiety is not exclusive to males or to females, but is found in both genders. Furthermore, math anxiety affects students as well as adults who suffered from math anxiety as a child. Math anxiety is not something that a person grows out of or runs away from; the person must deal with the problem and conquer math anxiety. To overcome math anxiety however, it is important to understand its origin and causes.

ORIGIN AND CAUSES

The origin of a student's math anxiety is generally a result of several experiences and cannot always be traced to one experience. Math anxiety can be a result of a teaching style, an experience in the past, poor textbooks, the attitude of a teacher,

classroom environments, the importance of grades, time limits, etc. I will discuss a few specific examples that seem to be relatively common in education today.

Teaching math symbolically and procedurally instead of using manipulatives and visual aids is a main cause of anxiety in students in today's classroom (Curtain, 2004).

When mathematics is presented in this manner, students tend to see math as a discipline where one right answer exists, and there is one right way to arrive at the answer.

Students also stress over making a single mistake in their work resulting in the wrong answer and, depending on the grader, a loss of all the points (Miller & Mitchell, 1994).

Other students recognize timed tests or projects as a cause of their math anxiety. In the past timed tests and rote memorization of facts have played a prominent role in mathematics instruction. These time limits cause unnecessary tension and stress, but tend to be a regular part of math classes (Curtain, 2004)

Students' experiences in the classroom, especially public humiliation, play a large part in their level of anxiety. Some students can recall one moment in their education where a math teacher made a fool out of them during class, or told them they would never be good at math. This type of encounter can cause a student who might have had success in math to develop a negative attitude towards mathematics. Studies show that attitudes play a large part in the success of students; students with a negative attitude seem to give up more quickly than those with a positive attitude (Miller & Mitchell, 1994). It is necessary for students to have a high level of success or a level of failure that they can handle (Curtain, 2004).

Textbooks also have a tendency to be a source of math anxiety among students. Textbooks which tend to stress definitions fail to help students make concrete

connections between concepts and experiences in their lives. (Miller & Mitchell, 1994). Precise mathematical statements are generally followed by symbolic examples that fail to help students develop an understanding of the concept. “Consider the difficulty children would experience growing up if in response to the question ‘What is a cat?’ they were told it is a domesticated member of the feline family” (Miller & Mitchell, 1994). As a result, students view math as a list of rules and definitions that are not related, which in turn makes the subject impossible to learn because of the long list of definitions and rules.

In addition to texts, teachers often fail to recognize the abstractness of the topic they are teaching. Failure to recognize this abstractness results in teachers overestimating a student’s capacity to understand material and its connection to math as a whole. This failure results in frustration among the students and teacher. Ultimately, this frustration is often the source for conflict or public humiliation between teachers and students.

IDENTIFYING MATH ANXIETY

Identifying students who have math anxiety is as hard as identifying the cause of math anxiety. All students are possible victims of math anxiety; even good students can suffer from mild math anxiety, especially on test days. A student who suffers from anxiety is often labeled as a student who does not try or does not understand math. However, some students who suffer from math anxiety are surprisingly hard workers in the classroom, study regularly, and always finish their homework. Students can work very hard, do their homework, pay attention, and still lack the ability to show what they know because of math anxiety. On the other hand, some students struggle to pay attention or to grasp a concept because they are so anxious or nervous about being a

failure. In this same category are students who are not nervous or anxious, but have made themselves incapable of paying attention because they believe that they will never understand math. These students then tend to be disruptive in the classroom because they have no intention of learning math or paying attention. As a result, these students are labeled as troublemakers, when they are actually struggling with their confidence in the math classroom.

ASSESSING MATH ANXIETY

In my research of math anxiety, I found very few measures for math anxiety and nothing that I felt would really help a teacher understand what a student is thinking about while in the math classroom. In order to better define and recognize math anxiety in students, I created a questionnaire in which students can share how math anxiety affects them.

In creating the survey, I tried to ask questions that were relevant to students in middle school and high school mathematics classrooms: questions about calculators, manipulatives, foldables (interactive note-taking by folding paper), time constraints, and study habits are among those asked. The first part of the questionnaire is a list of multiple-choice questions for which students pick the answer that describes them the best, while the second part is a list of statements that students are asked to rate based on their confidence. The final part of the questionnaire is a list of writing prompts that ask students to share their feelings and experiences in math. The questionnaire can be found in Appendix A.

I administered these questionnaires for the first time while student teaching as an undergraduate at Ball State University. I gave the first two parts in my middle school

math classes and asked the English teacher on my team to help with the writing prompts. I felt that the students might be intimidated by the presence of a math teacher when they were answering the open-ended questions, so I asked the English teacher to work the prompts into her daily journal assignments. The prompts do not have to be given by an English teacher, but I believe students will be more apt to say what they believe if the prompts are given by a third party.

RESULTS

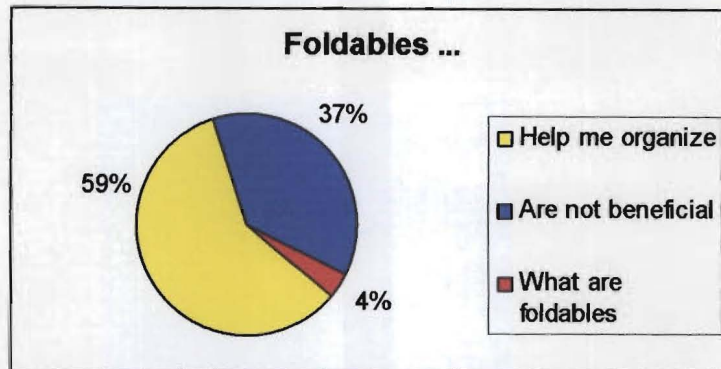
The results below are a reflection of the 102 students I worked with and are not necessarily representative of students in general. In working with the data from the questionnaires, it seems that some results could be generalized to describe all students while some results were very specific to the students who answered the questions. All students surveyed are enrolled in an urban middle school with relatively low socio-economic status.

The complete results from the questionnaires can be found in a table in Appendix B. The table gives the total number of responses for each given choice. It is important to note that some students failed to answer certain questions, resulting in the total number of responses for some questions to be less than 102. Below are the results and graphs for a few questions that I found interesting and chose to look at more closely.

Multiple Choice Question 5 “Foldables”

Since studies have shown it is important to keep students active in the classroom, making foldables is a great way to keep kids active and taking notes at the same time. It's evident that the majority of the students believe that foldables are beneficial. For the 37% who answered that they are not beneficial, it is my opinion that this may be a result

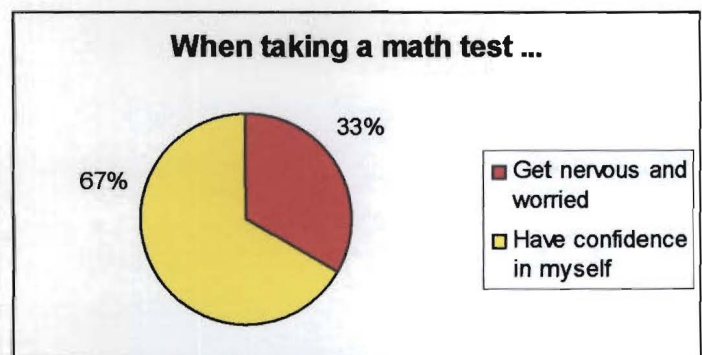
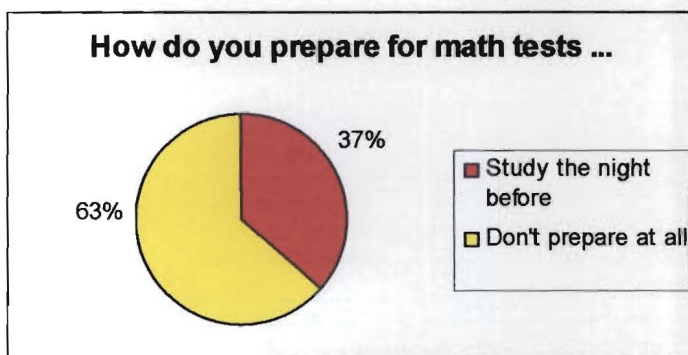
of students who just don't like creating the foldables, because of a bad experience in another classroom. Regardless this definitely supports the use of foldables in a math classroom.



Multiple Choice Questions 8 & 9 "Tests"

I chose to look at these two questions together because of their possible correlation.

Question eight asks students how much they study before a test or quiz while question nine asks students how they feel when taking tests. Students were asked to respond by saying they were confident or that they were nervous and worried.

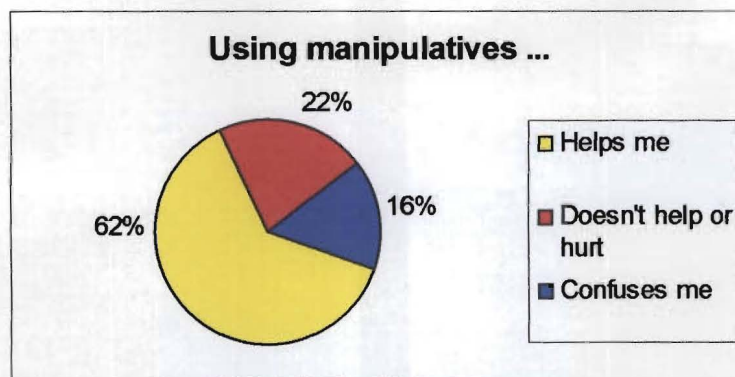


It is clear that many students do not study for tests and that this has no affect on their attitude while taking the test. However, further analysis of the data shows that 27% of the students who said that they study the night before still said that they were nervous or

worried when taking the test. These students would be prime candidates for math anxiety. Furthermore, 33% of the students who said that they did not study the night before were worried or nervous about the test.

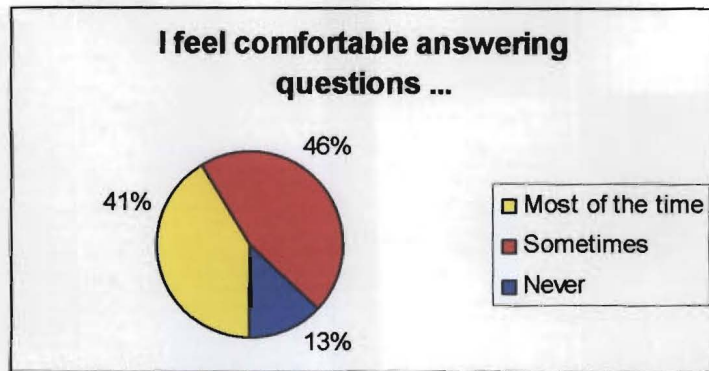
Multiple Choice Question 4 “Manipulatives”

Question four simply asked students to respond to the use of manipulatives in the classroom. The majority of the students responded that manipulatives help them understand, which agrees with research that says the use of manipulatives in the classroom helps students develop a better understanding of concepts.



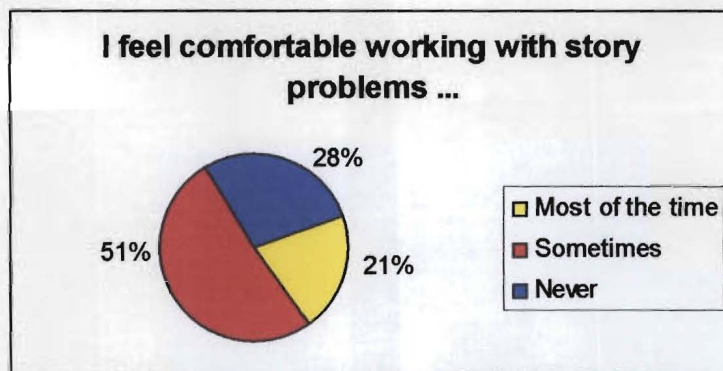
Confidence Question 1 “Answering Questions”

The willingness of students to answer questions in math class is a definite indicator of math anxiety. If a student expresses uneasiness in volunteering or participating there is a good chance that this person has some sort of math anxiety.



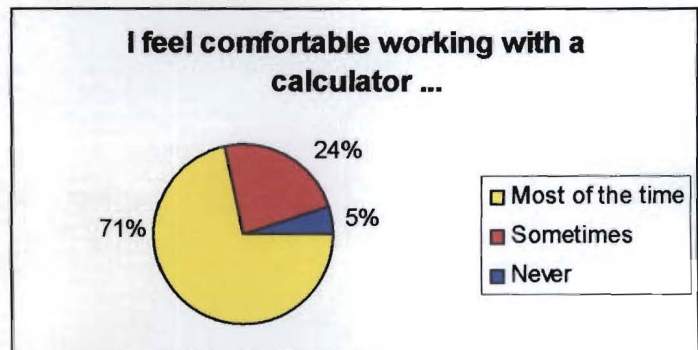
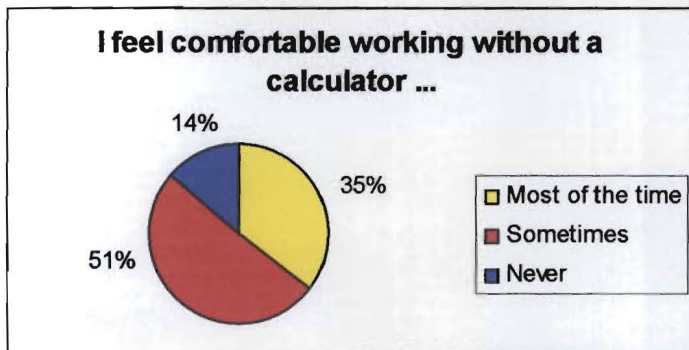
Confidence Question 3 “Story Problems”

Story problems in general tend to make many math students anxious.



Although it seems as though a large majority (72%) of student are comfortable with story problems, I believe that several of the students who answered **sometimes**, may not ever actually be comfortable when working with story problems. When filling out a questionnaire, it tends to sound better to answer “sometimes”, instead of saying, “I never feel comfortable with story problems.” On the other hand, there is a large portion (28%) of students who are never comfortable working with story problems.

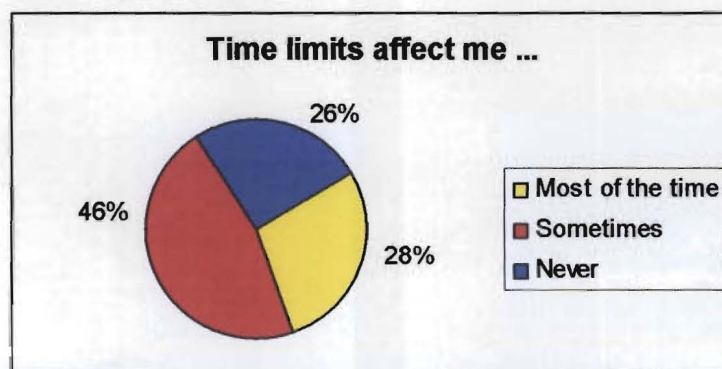
Confidence Questions 4 & 5



It is interesting to note that responses to question four show 86% of students are comfortable **without** a calculator “most of the time” or “sometimes,” while question five shows that 95% of students are comfortable **with** calculators “most of the time” or “sometimes.”

Confidence Question 10 “Time”

Time is always a factor when talking to a student who has math or test anxiety. It is something that teachers and students struggle with in the classroom every day. This particular question asked students how time limits affect them when taking a test.



The results show that 74% of students say that they are affected to some degree by time limits on a test. It is interesting to note that 35% of the students who said that they are anxious or nervous about tests said that time affects them **most of the time**, while another 32% of the students who said that they were anxious or nervous during tests said that they are affected **sometimes** by time limits.

Open-Ended Responses

The open-ended questions were given to the students in English class as a part of their journal and when they were finished, I read through them. I have taken just a few of the responses from the students to include here. The sentences are straight from the journals and are not the entry in its entirety, but a just a few lines that I chose.

One time I felt good about math was when ...

"...well never I guess, I don't like math it is boring."

"... there was a hard problem I couldn't figure out, but then I did it all by myself without any help."

I dislike math because ...

"...there is too much thinking. There is too many numbers and different ways to do things."

"...it's too confusing and you have to remember a lot of formulas."

"I don't dislike math because it is my favorite subject."

One time I was upset or discouraged about math was when ...

"...I couldn't figure out a problem, needed help and couldn't get it because it was a test."

"...I forgot how to do some math problems on a test and got a bad grade."

If I could describe math as any animal it would be ...

"...a cat because a cat can be friendly then again mean."

"...a snake because it kind of sneaks up on you and then it comes at you really fast and is hard to handle."

"...it would be an ant so I could step on it."

The responses from the open-ended questions were rather interesting and gave me a chance to get inside the thoughts of my students. Unlike the multiple choice and confidence, questions the students are able to write down exactly what they feel, instead of being restricted by a given set of answers. The students were very honest in writing about their feelings and attitude towards math.

The data from all three parts of the questionnaires gave me an idea of students who might be struggling with math anxiety. I was also able to identify activities or constraints that cause students to become anxious in a math classroom. In addition to looking at individuals, the results from the graphs provide a large picture representing all of the classes. Ultimately, the results gave me a chance to reflect upon and revise my teaching strategies so that I can assist my students combating math anxiety.

COMBATING MATH ANXIETY

The following is a list of suggestions I have created based on the results from the questionnaires to help teachers combat math anxiety in their classroom.

- Be positive in the classroom and avoid being negative when students give an incorrect response.
- Use manipulatives and other forms of math communication.

- Construct tests that have multi-part questions that test ideas so that small computation errors will not result in losing all the points.
- Give partial credit, and encourage students to show all of their work and/or share anything they know about the problem.
- Discuss in class the correct way to utilize textbooks.
- Keep from basing instruction entirely on definitions; make the material relevant to the students.
- Work on problem solving strategies as a class, and model good problem solving daily.
- Set students up to succeed, not fail.
- Try to involve parents and families as much as possible.
- Create a community of learners, where students can rely on each other to help them when they are struggling or praise them when they succeed.
- Design activities that utilize small groups of students working together.
- Allow students to have an input in the development of the classroom environment and curriculum.

FINAL THOUGHTS

Math anxiety is a real fear, generally a result of experiences, and is very dangerous to the mathematical development of students. Something or someone has given students a reason to be anxious or have negative attitudes towards math. The goal of teachers, administrators, and parents should be to identify students who have math anxiety and help them overcome the anxiety. At the same time teachers need to make sure they are doing all they can to keep other students from developing math anxiety.

Teachers can help students conquer or avoid math anxiety by informing students' parents and coworkers about strategies that can help students. Teachers can do everything from change their classroom environment to modify their teaching strategies, but it may first be necessary to assess the levels of math anxiety in students. Parents and administrators can also help by encouraging students as they struggle to overcome math anxiety. Along with the assistance of teachers, parents, and administrators the students must be directly involved. The students are the ones that must recognize, overcome, and deal with the effects of math anxiety. In the end, it is for the student, to help them realize the importance and elegance of mathematics.

APPENDIX A

Sex_____

Grade_____

Class_____

Math Questionnaire (Part 1)

1. I enjoy math class.... Yes or No
2. When I walk into a math class, I feel
 - a. Relaxed
 - b. The same as any other class
 - c. Anxious or nervous about doing math
3. During math lessons I,
 - a. Am able to focus and understand
 - b. Can focus, but can't understand
 - c. Try to focus, but lose interest quickly
 - d. Don't pay attention, because I can't do math
4. When a teacher uses manipulatives to explain something?
 - a. It helps me understand the topic
 - b. It doesn't help or hurt me
 - c. It confuses me
5. Foldables ...
 - a. Are not beneficial for me
 - b. Help me organize my notes
 - c. What are foldables
6. When given homework in math,
 - a. I use my notes and try all of the problems
 - b. I do the homework but don't use notes
 - c. I occasionally do my work
7. When I get to a problem I don't understand, I
 - a. Quit and move on
 - b. Work on the problem and ask questions
 - c. Quit doing homework completely
8. How do you prepare for math tests
 - a. Study the night(s) before
 - b. Don't prepare at all

9. When taking a math test, I
 - a. Get nervous and worried
 - b. Have confidence in myself
10. When I don't know how to do a problem on a test, I
 - a. Get flustered and perform poorly on the rest of the test
 - b. Skip the problem
 - c. Work on the problem and do what I can
11. When other people start to turn their test in,
 - a. I am not affected
 - b. I get worried about taking too long and lose focus
 - c. Rush through the rest of the test to be done early
12. My performance on tests can be summed up by
 - a. I work hard in class do my homework and do well on the test
 - b. I work hard in class and do well on my homework, but I don't do well on the tests
 - c. I work hard in class, but struggle with my homework and then struggle on tests
 - d. I don't do well on tests because I don't try and don't study

Math Questionnaire

(Part 2)

Please rate the questions with the following scale.

3-Most of the time

2-Sometimes

1-Never

_____ I feel comfortable answering questions in math class.

_____ I am confident when doing computation problems.

_____ I am comfortable working with word and story problems.

_____ In math class, I feel comfortable working without a calculator.

_____ In math class, I feel comfortable working with a calculator.

_____ I feel comfortable when working in groups.

_____ I feel comfortable asking the teacher(s) for help.

_____ I feel prepared for tests and quizzes in math class.

_____ I study the night(s) before a test or quiz.

_____ Time limits affect my performance on tests.

Open Ended Math Prompts
(Part 3)

A. When I hear the word math, I....

B. I like math because....

C. I dislike math because....

D. One time I felt good about math was when....

E. One time I was upset or discouraged about math was when....

F. If I could describe math as any animal it would be.... Why?

APPENDIX B

Complete Results (In table format)

Multiple Choice Questions (Part 1) Results

Question	A	B	C	D
1	64	26	12	N/A
2	16	74	12	N/A
3	38	26	32	5
4	63	22	16	N/A
5	38	60	4	N/A
6	20	54	25	N/A
7	34	55	13	N/A
8	37	64	N/A	N/A
9	32	64	N/A	N/A
10	11	21	61	N/A
11	58	26	10	N/A
12	34	19	30	9

Confidence Questions (Part 2) Results

Question	Most of the time	Sometimes	Never
1	42	47	13
2	36	53	13
3	21	52	29
4	36	52	14
5	73	24	5
6	60	34	8
7	58	36	8
8	27	58	17
9	15	50	37
10	28	47	26

Bibliography

- Ashcraft, M. H. (2002). Math Anxiety: Personal, Educational, and Cognitive Consequences. *Current Directions in Psychological Science*, 11(5), 181-185.
- Curtain-Phillips, M. *The Causes and Prevention of Math Anxiety*. Retrieved October 10, 2004, from http://www.mathgoodies.com/articles/math_anxiety.html
- Furner, J.M., & Duffy, M. (2002). Equity for All Students in the New Millennium: *Disabling Math Anxiety. Intervention in School and Clinic*, 38(2), 67-74.
- Miller, D.L. & Mitchell, C.E. (1994). Mathematics anxiety and alternative methods of evaluation. *Journal of Instructional Psychology*, 21(4), 353-358.
- Sutton, S. (2004, March). Remedies for the Pain of Math Anxiety. *Eisenhower National Clearinghouse for Mathematics and Science Education*, 7-10.